Space Weather Technical Forecast

Issued on Thursday, 25 August 2022 at 01:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Active fluence likely persisting for another day. Multiple sunspots but currently all quiet.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low, with no significant flares observed. There are six sunspot regions on the visible disc, three of which are unnumbered. The largest region remains to be AR3085, however is stable and no longer developing. AR3086 continued to develop and grow, becoming more elongated although it conserved the same number of spots. AR3087 and the new region in the northeast quadrant are both simple Alpha/Hsx. Another new region in the SW quadrant has grown significantly over the past 24 hours and is north-south orientated (unusual). It is, so far, of simple Beta magnetic configuration, but there is evidence it's rapid appearance is pushing on the surrounding corona and causing it to destabilise in places, so close attention for non-flare CMEs will be paid. Currently, no Earth-directed CMEs were observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, followed a broad declining trend over the last 24 hours, reducing erratically from 450 to around 400km/s. There was an erroneous period of 500km/s showing up on DSCOVR between 1600-2000UTC which can be ignored as it didn't show on ACE, likely down to a low solar wind density period (known error). Otherwise, the density was generally average or below average. The total magnetic field strength (IMF) Bt, was generally weak, between 5-7nT, with only small fluctuations in Bz. The phi angle was negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES-16, was at Background levels. The high energy electron flux (greater than 2 MeV) remained at High levels, with a peak of 3160 pfu at 24/0010 UTC and on a slow declining trend. The 24-hour integrated electron fluence remained above the the Active threshold (1e8 integrated pfu) throughout the period, also now showing a slow declining trend. A value of 1.87e8 total pfu was observed at 25/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain mostly Very Low or Low through this period based on the current configuration of sunspots, with only a slight chance (15%) of M-class flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in this forecast. Solar winds are expected to remain at background levels with geomagnetic activity also remaining largely Quiet. A slight enhancement is possible at the end of day 2 (26th) and into day 3 (27th) under the influence of CH18/+ but its impact on geomagnetic activity should be small, with perhaps isolated Unsettled or Active intervals.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is

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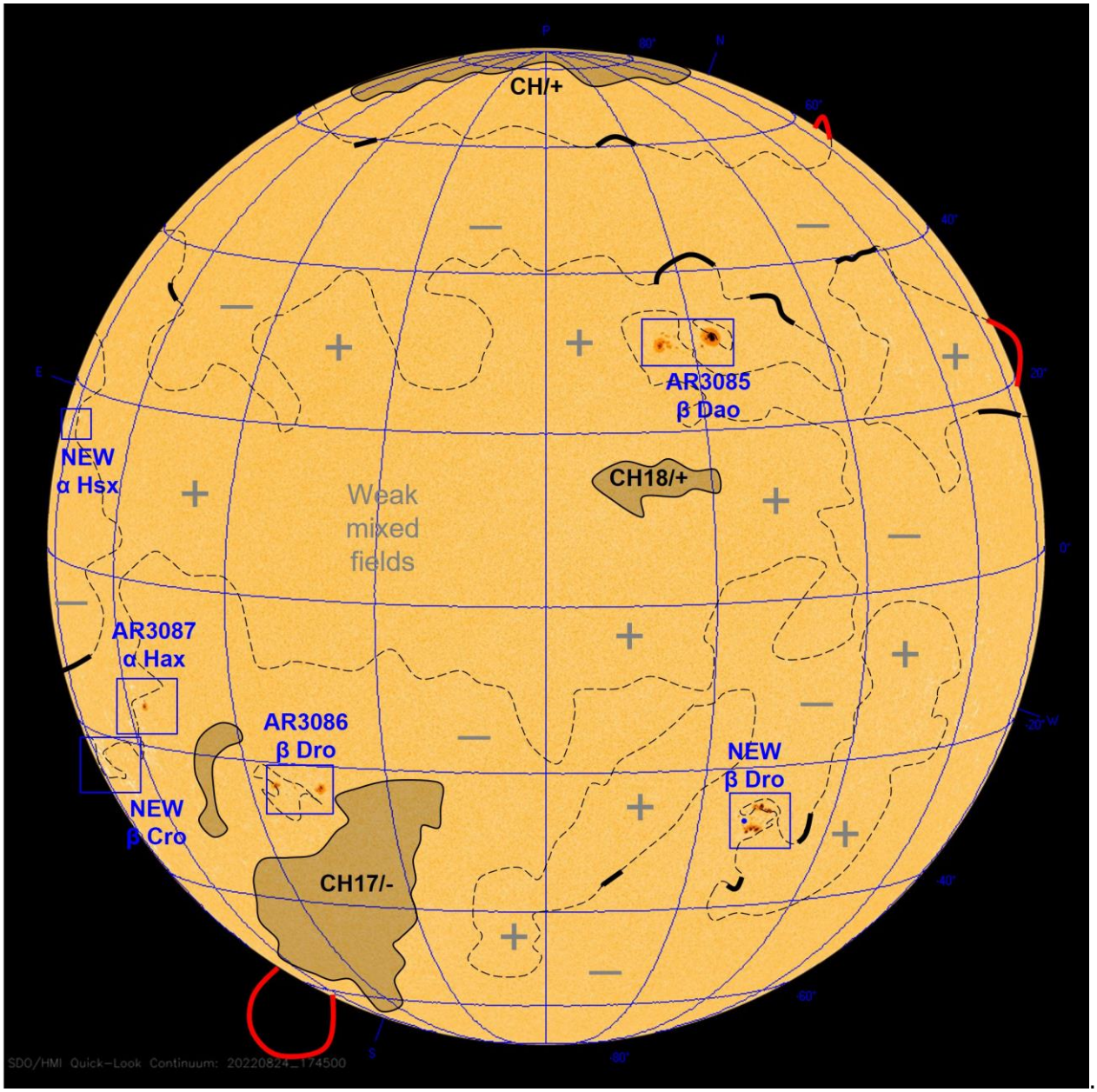
forecast to remain at Background levels. The high energy electron flux (greater than 2 MeV) is currently at High levels but is expected to see a decrease in peak values to finally drop to background and moderate levels. Consequently the associated active 24-hour fluence is expected to continue to show a decreasing trend, likely dropping back below the 1e8 threshold by the end of the 25th (Day 1) or early 26th (day 2) based on the current trend.

Figure 1. Solar Analysis Valid 24/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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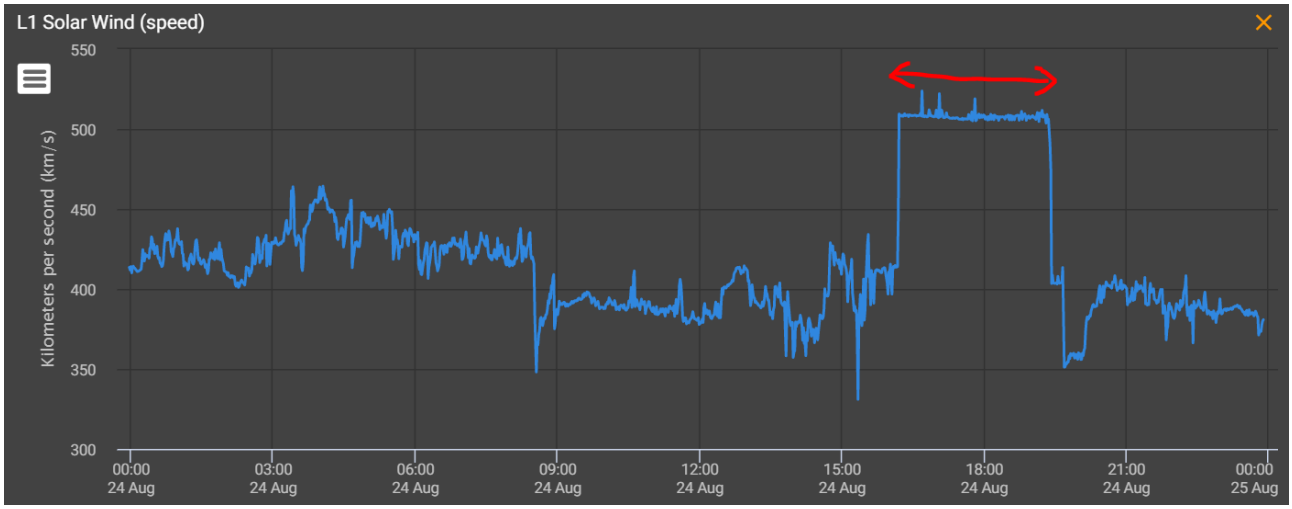
Geomagnetic Storms:

No Earth-directed CMEs currently feature in this forecast. Solar winds are currently slightly elevated, around 400km/s, with no significant enhancements expected and a geomagnetic activity remaining largely Quiet (Kp0-2). The next coronal hole is CH18/+ and is expected to become geoeffective at the end of day 2 and into day 3 (26th and 27th). It is a recurring feature, however it achieved very little in terms of speed and geomagnetic activity on the last rotation and despite being slightly larger this time round, its impact is expected to remain small, so isolated Unsettled or Active intervals possible (Kp3-4).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections – NONE EXPECTED

Figure 2: DSCOVR Real-time Solar Wind trace, showing easing trend and also highlighted the erroneous period of 520km/s, which was not reflected at ACE and is likely down to a period of low-density, where the instrument struggles to ascertain the solar wind speed when density is very low.



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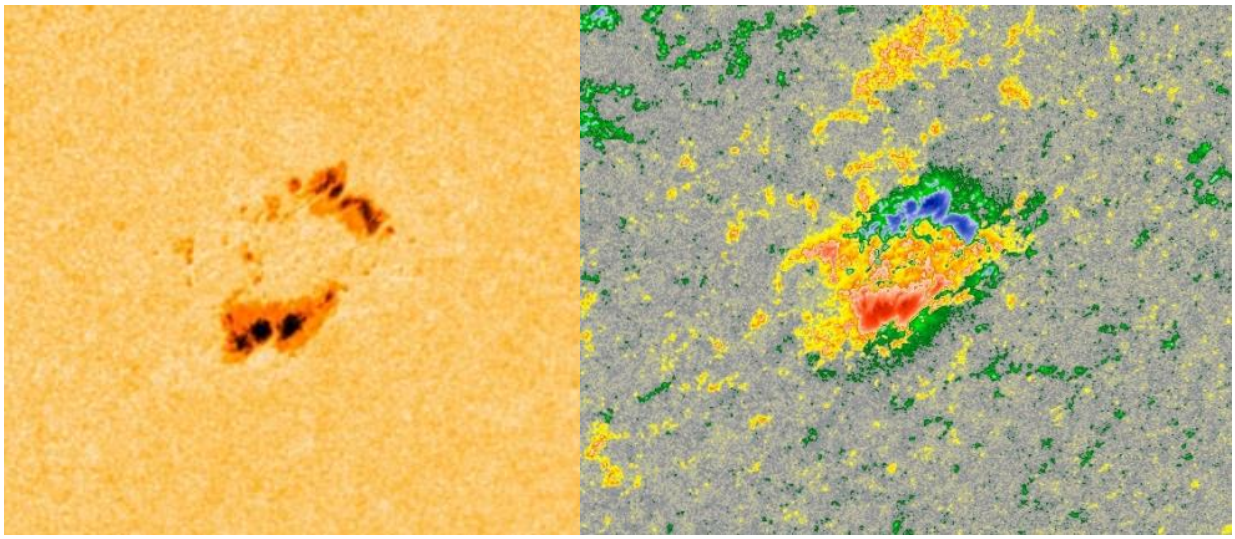
Radio Blackouts - X-Ray Flares:

Solar activity has been Very Low, with no significant flares. There is however a growing chance of C-flares and a slight chance of M-flares, particularly since a new region rapidly developed in the southwest quadrant.

There are now six sunspot regions on the visible disc, three of which are unnumbered but one of these (S24E73) is growing rapidly. The largest and most complex region remains AR3085, however it remains simple and is no longer growing. AR3086 has also seen some of its intermediate spots vanish and is simplifying. AR3087 and the new region in the northeast quadrant both remain small and simple, and another perpendicular south of this appears at these early stages to be a Beta, but close to the limb so unable to analyse with any degree of accuracy. Finally the 3rd new region which has quickly emerged in the southwest quadrant is vertically aligned, but of Beta arrangement and with multiple merged bipolar spots.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Close-up of the latitudinal-orientated sunspot region at 24/2315UTC in the SW quadrant.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels and is expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux as measured by GOES-16 is currently High after recent coronal hole and CME enhancements. With no further enhancements expected which could potentially drop the electron counts, only a gradual reduction in peak values is likely. The electron flux should eventually drop to background and moderate levels perhaps by day 2 (26th) although confidence is low with regards to timings.

The associated fluence is expected to reflect this decreasing trend, likely remaining Active (above 1e8 pfu) through today and perhaps lasting into early day 2 (26th), before coming back below threshold thereafter. While the trend of the fluence on our latest REFM is accepted, it is considered an under-estimate at this stage as it shows a forecast of below 1e8 fluence by 25/0900Z, which is too early.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	50	20	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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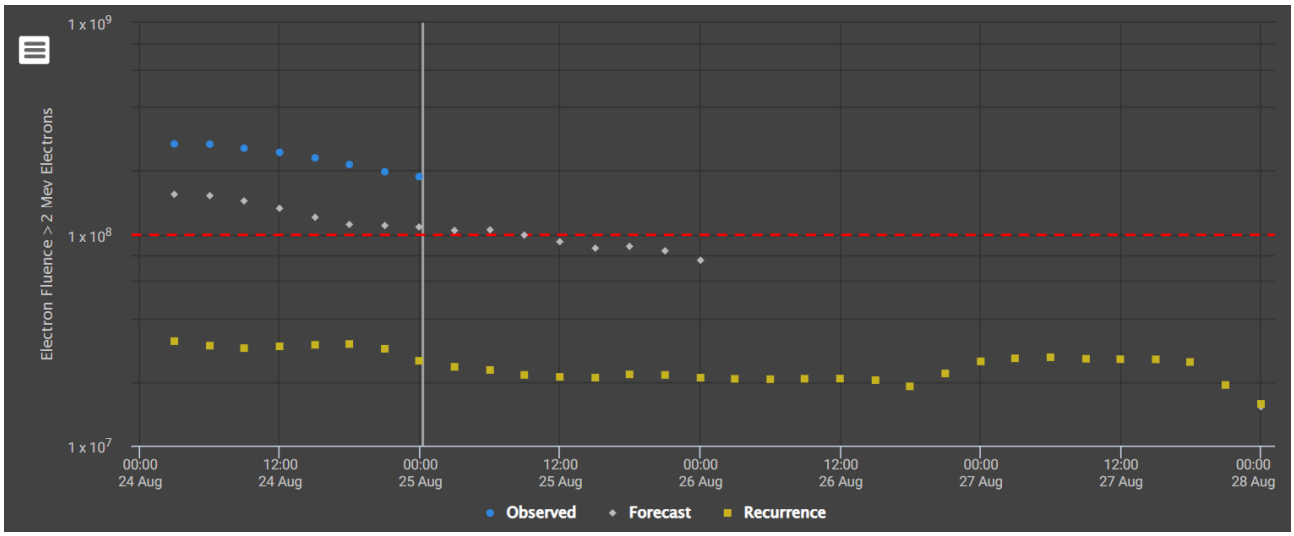
Figure 5: Latest REFM – also showing the 25/0000Z figure at 1.87e8 pfu.



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